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OCCUPATIONAL RESEARCH DATA BANK:
A KEY TO MPTS ANALYSIS SUPPORT

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SUMMARY

Manpower authorization shortages, increasing skill requirements, and Congressional/DOD concerns for weapon system (WS) life-cycle support costs mandate that manpower, personnel, training, and safety (MPTS) issues become integral parts of new WS planning, conceptual development, and design trade-off decisions. The Air Force Human Resources Laboratory (AFHRL) is currently developing technologies, tools, and data bases to help address this need. One of the most important of the data bases in MPTS support is the Occupational Research Data Bank (ORDB). The ORDB provides storage and on-line retrieval of a variety of occupational data, thus streamlining the laborious and time-consuming process of finding background information through requests to computer data bases or searching regulations, technical reports, or previous research/occupational analysis studies. The ORDB consists of six subsystems providing (a) listings of documents relating to Air Force jobs; (b) Air Force specialty descriptions from 1978 to the present; (c) background data on Air Force enlisted personnel; (d) a process for rapid retrieval of reports from the most recent occupational study for any specialty; (e) a process to collapse data from the previous four subsystems into a single output product; and (f) an ORDB/SPSS interface allowing within-system statistical data analysis. Information within the ORDB is critical to a number of MPTS efforts within AFHRL, as well as to work underway in the Air Force Systems Command MPTS Directorate.

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PREFACE

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OCCUPATIONAL RESEARCH DATA BANK:
A KEY TO MPTS ANALYSIS SUPPORT

I. INTRODUCTION

A major thrust to enhance consideration of manpower, personnel, training, and safety (MPTS) factors throughout the Weapon System Acquisition Process (WSAP) has begun within each of the military services. Reduced budget constraints, as well as significant manpower shortages and a growing need for highly skilled personnel to operate and maintain increasingly complex weapon systems, have necessitated a more efficient use of available manpower resources. Growing pressures from Congress have mandated that the Air Force develop forecasts of MPTS requirements early in the design process of a new weapon system. MPTS goals and constraints need to be developed during the Pre-Concept and Conceptual Exploration stages in order to include this information in controlling documents such as the Statement of Operational Need (SON), System Operational Requirements Document (SORD), and the contract Statement of Work (SOW).

At present, MPTS considerations are not effectively included in early design tradeoff decisions or in the development of operational and maintenance concepts. We lack the tools necessary to assess the total force impact(s) and life-cycle supportability costs of MPTS decisions related to the introduction of new weapon systems or to the modification of systems currently in the inventory. The acquisition process itself does not provide detailed information sufficiently early to permit personnel and training pipelines to be properly established prior to delivery, thus causing delays in the assimilation of new systems into the operational force. Although some data bases and analysis tools are available to support M, P, T, and S decisions, management of MPTS in the Air Force is very decentralized, making it difficult to integrate information from these various sources.

A major step toward MPTS integration is the advent of IMPACTS, the Air Force program for Integrated Manpower, Personnel, and Comprehensive Training and Safety. IMPACTS is an acquisition management program that implements specific DOD policy regarding MPTS and is designed to support the development of mission-capable systems that can be safely operated, maintained, supported, and contained in present and future operational environments at the lowest life-cycle cost. In support of IMPACTS, research efforts are underway to define and develop a comprehensive and integrated MPTS analytic system for use in the WSAP. As part of this effort, an assessment of the tools and data bases currently available to support MPTS decisions will be made, along with an in-depth analysis of their strengths and weaknesses. Examples of modeling and data systems to be examined include the Logistics Composite Model (LCOM), supported by data input from the Maintenance Data Collection System (MDCS); the Logistics Support Analysis (LSA) and LSA Records (LSAR) available from prime contractors; and the Occupational Research Data Bank (ORDB), a system developed by the Air Force Human Resources Laboratory (AFHRL) to provide researchers a variety of occupational information on enlisted Air Force Specialty Codes (AFSCs).

The ability to integrate information from these various data bases is very important. Techniques and software are being developed to interface these data bases; however, these efforts are still in their infancy. In the interim, MPTS analysts must be able to use the information from existing data bases that is available today. Data from available sources will be especially critical during the Pre-Concept and Concept Exploration Phases in the acquisition of a new weapon system. Data collection at these two stages must include the identification of a comparable predecessor system and generation of baseline data relying on the weapon system(s) in the current inventory most similar to the emerging system. Using the existing weapon system's MPTS environment as a baseline, the MPTS analyst will be able to assess shortfalls in meeting new MPTS requirements and be able to perform "what-if" analyses on alternative weapon system designs and alternative MPTS structures.

This paper addresses the potential MPTS applications of one existing data source, the ORDB, developed and maintained by the Manpower and Personnel Division (MO) of AFHRL. The ORDB is an up-to-date occupational research data base containing a wide variety of both historical and current information on enlisted and officer career fields. In the following sections, we will first provide a brief description of the kinds of information available within each of the ORDB subsystems. Second, we will outline steps and provide examples which MPTS analysts might currently use to establish a predecessor-system baseline data file from which estimates of MPTS requirements for new and emerging weapon systems may be made. Finally, we will consider possible longer-term modifications to the ORDB system to help meet the needs of early MPTS analysis.

II. BACKGROUND/OVERVIEW

Plans for the development of the ORDB began in 1978, following the realization that while vast quantities of information were available about Air Force occupations, the data were widely dispersed among many different organizations using many different formats and degrees of coverage. At that time, AFHRL alone maintained 29 different kinds of computer files generated by many different sources. Additionally, other organizations (HQ United States Air Force, Air Training Command, Air Force Military Personnel Center, etc.) each had their own data bases and generated numerous recurring reports, regulations, and studies. Also, the Laboratory housed Air Force technical reports dating back to 1943 and was the official Air Force repository of all occupational study data files generated by the USAF Occupational Measurement Center (USAFOMC). Occupational researchers at the Laboratory needed a way to consolidate this information and make it rapidly accessible to a variety of possible users.

Today's ORDB is an on-line system housed on the AFHRL UNISYS 1100/82 computer at Brooks Air Force Base, Texas. Access to the system by outside organizations is made possible via modems or computer communication lines, such as the Defense Data Network (DDN). The basic design of the ORDB was created in a user-friendly, tutorial environment where users are guided through the simple interface routines. The data base consists of four major subsystems from which the various types of occupational information and statistics are accessed:

1. Computer Assisted Reference Locator (CARL). This subsystem contains listings of occupational studies, technical reports, and other documents related to Air Force jobs. Each reference in CARL includes such information as author/Office of Primary Responsibility, title of the reference, type of reference, a brief narrative description, and an associated list of key terms for each. Key terms input by the user are the basis for searching and accessing routines which identify and display the desired references.

2. Aptitude Requirements Component (ARC). This subsystem contains up-to-date information from Air Force Regulation (AFR) 39-1, Airman Classification, which establishes the occupational structure of the enlisted force. The ARC contains AFSC descriptions (for ladder and career field), progression ladders, aptitude requirements, and specialty prerequisites from 1978 to the present. It also has an AFSC designator change history file which tracks all changes from March 1965 through the present.

3. Statistical Variable Subsystem. This subsystem contains statistical information on the enlisted force by AFSC, population group, and year, for a total of 125 different variables. AFSC-specific data are collapsed across individual records from a number of AFHRL data files including the Airman Gain/Loss (AGL), the Pipeline Management System (PMS), and the Uniform Airman Record (UAR).

4. Comprehensive Occupational Data Analysis Programs (CODAP) Reports Subsystem. This subsystem contains selected reports from Air Force occupational studies which have been conducted

by the USAFOMC. Six basic types of information are available in these computer-generated reports: tasks comprising the AFS; percentage of incumbents performing each task; relative percentage of time spent on each task; relative difficulty of each task; relative training emphasis recommended for each task; and summaries of background information such as equipment used or maintained, test or special equipment, and job satisfaction information.

Two additional ORDB subsystems use data from the four main subsystems. The Custom Reports Subsystem presents several unique custom report options to include CODAP-Statistics interface output or large-volume statistical retrieval. The ORDB-SPSS Interface Subsystem allows four different analysis procedures available within the Statistical Package for the Social Sciences (SPSS) to be applied to data from the Statistical Variable Subsystem.

III. ORDB MPTS APPLICATIONS

As an example, data available within the ORDB may prove useful in the development of the IMPACTS Program Plan (IPP)--especially in the Pre-Concept and Concept Exploration Phases, which often lack concrete data specific to the new system. The primary objectives of the IPP are (a) to establish MPTS goals and constraints; (b) to influence the design process through participation in MPTS trade-off analyses; and (c) to ensure that the necessary manpower authorizations--and qualified and trained personnel to fill them--are available to support the weapon system when fielded.

To be able to use the information within the ORDB, the MPTS analyst must first identify the weapon system or systems currently in the inventory which is/are most similar to the emerging system. For example, planners within the Advanced Tactical Fighter (ATF) System Program Office (SPO) have identified both the F-15 and F-16 tactical aircraft as the systems most comparable to the proposed ATF. As a result, the initial ATF data base will be based on information available from these two predecessor systems. Because information within the ORDB is presented by AFSC rather than by weapon system, the analyst must next identify those Air Force specialties which work that system. In some cases, this identification is relatively straightforward and can be obtained directly from the Airman Classification Structure Chart (AFVA 39-1). For example, AFSC 431X1, Tactical Aircraft Maintenance, is subdivided by alphabetical "shredouts" to identify specialization in a specific weapon system.

In most instances, however, a direct linkage between AFSC and weapon system is not available. For example, individuals holding AFSC 426X2, Jet Engine Mechanic, may work on a number of different aircraft. No identifier within the code itself specifies which weapon systems are maintained by that AFSC. How then can an MPTS analyst generate a list of pertinent AFSCs? One approach is to gather information from Subject-Matter Experts (SMEs) who are knowledgeable on the predecessor system. Another potential source of information is the Special Experience Identifiers (SEIs) which identify special experience and training not otherwise reflected in the classification system. AFR 39-1 contains a listing of all SEIs, along with their authorized AFSCs. Using the look-up chart available in the index of the regulation, all AFSCs authorized for an SEI can be identified. Using these AFSCs as inputs to the ORDB, the MPTS analyst can begin to extract data and build a predecessor system data file.

The first ORDB subsystem to be accessed by the analyst should be the Aptitude Requirements Component (ARC). The ARC provides a narrative description of the Ladder AFSC--431X1E, 426X2, 423X4--disregarding skill level; a narrative description of the career field--43XXX, 42XXX; a listing of the AFSC prerequisites including minimum aptitude scores, physical profiles, physical work capacity, certification or license requirements, mandatory training courses, etc.; AFSC Progression Ladders as they appear in AFR 39-1; and a complete AFSC designator change history, with additions, deletions, and skill-level changes available from 1965 to the present. The ARC

is a good starting point in obtaining a qualitative description of any AFSC. It essentially automates information as it appears in the latest publication of AFR 39-1.

Having obtained qualitative descriptions of the AFSC, the analyst would next access data available within the Statistical Variable Subsystem (Option "3") which contains basic population statistics extracted from individual case records in the UAR, AGL, and PMS data files. Frequency distributions, means, and standard deviations are generated for 125 variables and are summarized by Duty AFSC, with further breakdowns by calendar year and population group. The data are summarized at three levels: (a) career field (e.g., 43XXX, 42XXX); (b) ladder (e.g., 431X1E, 423X4); and (c) skill level (e.g., 42632, 43151F) and are available for the 5 most recent years. Variables of interest to the MPTS analyst may be grouped into four categories: First, basic demographic data are available as distributions of academic education level, skill level, age, grade, sex, race, ethnic group, and time-in-grade. Second, aptitude profiles for AFSSs can be generated through accessing distributions of Air Force Qualification Test (AFQT) and Armed Services Vocational Aptitude Battery (ASVAB) scores, broken down by Administrative (A), Electronics (E), General (G), and Mechanical (M) scores and further, by Major Command (MAJCOM), race, sex, and ethnic group. Third, personnel numbers are available as assigned strength by AFS, numbers assigned by major command and base, and gains and losses to the AFS by MAJCOM, Total Active Federal Military Service (TAFMS) group, and current year. Finally, forcewide information is also available for all 3-, 5-, 7-, and 9-skill levels across AFSCs or for the total Air Force population. For example, the average ASVAB Administrative score for all 3-level personnel in the Air Force is available, as are average Electronics and Mechanical scores for the 5- and 7-levels. Distributions based on the entire Air Force enlisted force are provided on a number of variables (Grade, Assigned Strength, ASVAB-General, etc.).

The final and most comprehensive subsystem to be accessed within the ORDB is the CODAP Study Reports Subsystem, which contains selected reports from Air Force occupational studies that have been conducted by the USAFOMC. The Air Force Occupational Survey Method (OSM) is an AFSC- or personnel-oriented system and--in contrast to MDC, LSA, and LCOM--is applied to most enlisted and officer AFSSs as well as some civilian-series positions. In terms of task specificity, OSM survey tasks tend to be more general than MDC, LSA, or LCOM tasks. OSM tasks seldom describe work performed at the component level. Their principal purpose is to provide information useful for training and job classification.

The basis of data produced by the OSM is the USAF Job Inventory, which consists of a background information section and a list of duties and tasks comprising the AFSC. The Job Inventory task list is the instrument for collecting relative ratings of time spent performing tasks, task learning difficulty, and task training emphasis. The background information section collects standard demographic information such as primary and duty AFSC, MAJCOM, TAFMS, etc. It also collects work-environment information such as equipment worked on and functional job area. Data collected from this background section serve as the basis for generating individual and group job descriptions for incumbents.

A number of different types of reports are available within the CODAP Reports Subsystem. The first type is the job description, which contains ordered lists of task or duty statements together with the percent of members in a group performing the task and an average percentage reflecting the time a member spends performing a task. These data are also available in group summary form. There is also the variable summary report, which contains frequency distributions for specified intervals, total frequency counts, and means and standard deviations on relative background and computed variables. These data are also available in percentages rather than frequencies. A third type of report provides task-level ratings of factors including task learning difficulty and recommended training emphasis. Relative difficulty ratings, defined in terms of how long it takes a person to learn to do the task, are collected from 30 to 50 senior-level Non-Commissioned Officers (NCOs), as are training emphasis ratings, defined as

importance to be taught during first-term training. Special task factor reports also show tasks (along with appropriate data) mapped under areas of the Specialty Training Standard (STS), a document produced by HQ ATC outlining all functions within an AFSC for the purpose of training personnel at that skill level.

IV. LONG-TERM MODIFICATIONS

Having considered current MPTS-specific applications for ORDB, it is now appropriate to address longer-term modifications to make ORDB more applicable to early MPTS analysis. Specifically, this means making the ORDB weapon system-specific as opposed to specialty-specific. Obviously, this transformation will not completely occur until the USAFOMC begins to survey by weapon system, at which point the AFHRL will have the capacity to store data and generate summary reports specific to unique weapon systems. While the RIVE WORK FORCE configurations are providing trends in this direction, necessary delays in surveying all relevant specialties and developing needed technologies will push this type of surveying into the 1990s. Until this time, certain steps must be taken to bridge the gap between our current short-term applications and the implementation of a new approach to occupational surveys. Though certainly not an exhaustive list, the following options are examples of possible ORDB modifications/extensions. All will require fairly extensive research efforts.

First, it is possible to build cross-reference tables specifically for ORDB data which would allow us to match specialties with a weapon system and vice versa. Starting points for such tables could come from areas such as SEIs and related specialties currently found in Air Force classification manuals. Utilization codes currently in the ORDB are another potential data source. It may even be necessary to tap major command resources and identify SMEs to help with the process. However it is accomplished, this option would provide a concrete link between weapon systems and specialties for ORDB data.

Second, use of currently available task-level data base matching technologies such as semantic-aided analysis will allow matching of survey task data with task data from the Maintenance Data Collection System (MDCS). MDCS data are weapon system-specific; so, this work would allow, at least by implication, ORDB task data to be "translated" into a weapon system-specific format. This technology is currently being cross-validated on an extended sample of specialties. Assuming current levels of matching hold, this option provides an excellent link between survey and weapon system data.

Third, we can match information on an individual's organization of assignment (available in the raw data from which ORDB was built) with the weapon system attached to that organization. While some possibility of working with classified information exists, this option allows us to look at a given weapon system and identify the specialties associated with it. Using this option would also allow generation of personnel data by cross-matching an aggregation of individuals working in a given organization and their current specialties, as well as their current weapon systems and lists of equipment supporting those systems. Demographic characteristics such as time in service, aptitude levels, and education, along with information such as tasks performed and amount of time spent on tasks, would be immediately applicable to an expanded job typing useful for identifying the optimum person/weapon system match.

V. CLOSING COMMENTS

Although it was originally developed as a research tool, the ORDB has rapidly become an important source of on-line information to an expanding list of users in the MPTS community. The examples and ideas discussed here provide important extensions to existing services. AFHRL is

currently in the process of using its own resources as well as user feedback to identify the best option(s) for ORDB modification which will provide the highest payoff for early MPTS analysis. This effort will help bring on-line an important data source for use in improving weapon system acquisition.

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